REPORT ON THE PRELIMINARY ASSESSMENT OF THE GEOLOGY AND MINERAL POTENTIAL OF THE EARLY PROTEROZOIC HURWITZ GROUP DISTRICT OF KEEWATIN

By: Judith Patterson

NWT GEOLOGY DIVISION - NAP
Box 1500 - Yellowknife

Indian and Northern Affairs Canada **Affaires indiennes et du Nord Canada**

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Introduction

Early Proterozoic supracrustal rocks of the Hurwitz Group crop out in a series of northeast-trending basins in the central portion of the Western Churchill Structural Province, from approximately 103°W, 59°N to 91°W, 63°N. The stratigraphy of the group is well documented (Bell, 1970; Eade, 1974; Eade and Chandler, 1975). A thick orthoquartzite package overlies basement or basal conglomerates. The upper portions of the sequence contain pelites, carbonate, arkose, and mafic volcanic rocks and gabbroic sills. Primary sedimentary structures are well preserved throughout the entire sequence, and metamorphic overprint is weak. It is therefore possible to do an integrated sedimentologic, structural, and tectonic analysis of the Hurwitz assemblage. The Hurwitz Group and other Early Proterozoic elements in the Western Churchill Province are inextricably linked in development. Understanding the depositional history and subsequent Hudsonian (late Early Proterozoic) deformation of the succession in the context of the evolution of the Western Churchill Province will contribute to extant models for the region, and provide insight into tectonic processes operative in the Early Proterozoic world.

In the past decade and a half, portions of the Western Churchill Structural Province, previously one of the most poorly understood portions of the Canadian Shield (Davidson, 1972) have been the focus of stratigraphic, structural, metamorphic and tectonically-oriented geological studies (e.g. Lewry and others, summary article, 1985; Hoffman, 1988; Lewry and Stauffer, in press). The dominantly siliciclastic Hurwitz assemblage has been modelled as a sequence deposited on a metastable craton (Bell, 1970), or a geosynclinal succession (Eade, 1974). Recent models place the Hurwitz Group as part of the cratonic foreland (Lewry and others, 1985), the "South Keewatin Zone" (Lewry , 1987), of the Trans-Hudson Orogen, or platformal cover on the Archean Hearne Province (Hoffman, 1988). Southeast of this region, to the juncture with the Superior Craton, the Ensialic Mobile Zone, Rottenstone-LaRonge Magmatic Belt, Southeastern Complex (including a volcano-plutonic arc, an interarc basin, and possibly a telescoped forearc prism

and a microcontinent) and the Churchill-Superior Boundary Zone have been documented (summarized in Lewry and others, 1985). Geological investigations within a plate tectonics framework which led to the recognition of the above listed orogenic domains has not yet been applied to the Hurwitz Group. The importance of understanding the Hurwitz Group in the context of the evolving Churchill Province lies in that it can shed light on the development of the Western Churchill Structural Province, and potentially, other orogenic systems.

Geologic investigations by the principal investigator commenced in the summer, 1988. Mapping and section measuring was done in four areas to provide a reconnaissance look at the Hurwitz Group both along and across strike to determine areas suitable for more detailed studies (figure 1). Logistics determined, in part, the areas which were examined.

Southwest end of the Whiterock Belt

Geology of the southwest end of the Whiterock Belt (figure 1, location 1) is shown in figure 2. Stratigraphy of the Hurwitz Group is shown in the legend to figure 2. Termination of the belt was not observed in the field, but is shown as cut off by a northwest trending fault by Heywood (1973).

Strata of the Hurwitz Group unconformably overlie the strata of the Kaminak Group, dominantly basalts with minor rhyolite. The contact between the Hurwitz and Kaminak Groups is never exposed. Along the northwest margin, the minimum separation of the Kaminak greenstone and Whiterock member of the Kinga Formation orthoquartzite is 4.8 metres. Frost heaves of slate are found in the covered interval, and isolated fins of fissile slate outcrop in the contact zone. It appears, therefore, that a thin interval of mudstone or siltstone occurs at the base of the Hurwitz Group. The Kaminak greenstone is non-foliated to schistose along the contact, the slate shows a good cleavage, and the quartzite of the Kinga Formation shows very little deformation. Therefore, it appears that any movement along the contact has occurred in the slate and variably affected the

greenstone. It is impossible at this time to determine the amount of movement that has occurred; there may have been only bedding plane slip to accommodate folding. Along the southeast margin, the contact is tectonized, and very poorly exposed.

The Whiterock member of the Kinga Formation is approximately 250 m thick along the northwest margin of the belt. Grain size is uniformly fine, 2-3 phi (0.2 to 0.1 mm). Bedding varies from thinly laminated to thinly bedded, with some medium to thick beds in the upper portions. Dominant primary features in the quartzite are spectacularly ripple-marked bedding planes, bedding-parallel stratification defined by heavy mineral segregations, and abundant low-angle (average 10° dip) trough cross-stratification. Plots of ripple orientation and crossbeds are shown in figure 3. A shallow marine and possibly partially aeolian environment is suggested for deposition of this unit.

Outcrop exposure in the overlying Ameto Formation is poor. Finely laminated slate and siltstone, overlying the Kinga Formation, is found only in frost boils. Pink carbonate is found in direct contact with Kinga Formation orthoquartzite in one locality. The contact is gradational by interleaving of carbonate and quartzite over 2.7 metres. The carbonate contains up to 50% shale laminae.

The volcanic rocks of the Happotiyik member are dominantly fine-grained greenstone, with some local tuff horizons. No pillowed or amygdaloidal rocks were found. Gabbros of the Happotiyik member intrude the sedimentary rocks of the Ameto Formation, and possibly the Tavani Formation. Isolated outcrops of gabbro occur in huge, drift covered areas, making exact determination of stratigraphic relationships impossible.

Tavani Formation of the Hurwitz Group occurs only in the Whiterock belt (Heywood, 1977). At the southwest end of the Whiterock belt, the formation is dominantly an arkosic arenite. Sets of tangential cross-stratification (figure 4) and graded bedding are common.

The general geometric form of the belt is determined by northeast-southwest trending, non-plunging folds. Localized second phase folds occur in Kinga Formation

quartzite and Ameto Formation carbonate at the southernmost portion of the belt, and trend 010, plunging moderately northeast. On the north margin of the belt, a southwest plunging fold (190/40) occurs just east of a late northwest trending fault.

Northeast end of the Kaminak-Quartzite Belt

Geology of the northeast end of the Kaminak-Quartzite belt (location 2, figure 1) is shown in figure 5. The Whiterock member of the Kinga Formation, Hurwitz Group, is in fault contact with Kaminak Group greenstones and granitic rocks of the basement along the northwest margin of the belt. Contact relationships along the southeast margin of the belt are covered.

Stratigraphy of the Hurwitz Group is shown in the legend to figure 5. A previously undocumented mafic volcanic tuff horizon occurs near the base of the Kinga Formation orthoquartzite along the northwest margin at the southwest end of the mapped area (figure 5). Preservation of primary structures here is less consistent than in the Whiterock belt due to stronger deformational overprint. Where structural overprint is weak, the suite of bedforms and sedimentary structures in the orthoquartzite (Kinga Formation) consists of ripple marks, bedding-parallel stratification, and low-angle tangential cross-stratification. Figure 6 from location X (figure 7) illustrates the degree and dominance of rippled sands in this unit. Ripples are symmetric or asymmetric. Due to metamorphic recrystallization and lack of clay laminae, it is impossible to determine if the asymmetric ripples are current ripples or if they are wave ripples formed in shallow water with a translatory component to the wave motion. Symmetric wave crests trend generally northeast-southwest throughout the belt (figure 8). Asymetric ripples trend northeast-southwest, and are usually steep on the northwest side (Figure 8). Orientation of the wave ripple crests suggests a paleoshoreline trending generally northeast/southwest. Interference patterns are common (figure 9). Strongly asymmetric ripples are vergent toward the reader, overprinted by orthogonal trending wave ripples.

Mafic volcanic rocks (Happotiyik member, Ameto Formation), massive to pillowed (figure 10), are volumetrically the most significant lithology of the upper portion of the Hurwitz sequence in this area. Gabbroic rocks (figure 5) intrude the sequence, and are presumably cogenetic with the mafic volcanic rocks, although the stratigraphic relationships between the two mafic igneous units were not observed. Carbonate rocks of the Ameto Formation consist of parallel stratified interlayered mudstone and carbonate, with some layers of pink quartzite. Slates of the Ameto Formation were observed only in frost heave.

Along the northwest margin, basement overthrusts the Hurwitz Group, verging southeast, and tight folds in the Hurwitz supracrustal sequence are overturned to the southeast. Folds become open and upright away from the tectonized northwest margin of the belt, and plunge gently (less than 10°) northeast or southwest (figure 5). Downplunge section A-A' (figure 7) illustrates the geometry of the belt in cross-section. Late northwest trending faults cut the northwest margin of the belt.

Southwest end of the Kaminak-Quartzite Belt

Beavon (1976) mapped a mafic volcanic unit (Spi Lake Basalt) and associated polymict conglomerates unconformably overlying Archean basement in the Carr Lake area (location 3, figure 1) and suggested that the conglomerates were an extension of the Kaminak-Quartzite Belt of Hurwitz Group rocks. Mapping was done in the Carr Lake area to test the hyposthesis of Beavon (1976) and possibly extend the Kaminak-Quartzite belt. As well, the potential of the conglomeratic units to be Witswatersrand-type gold-bearing paleoplacer deposits was evaluated.

Basement in the area consists of Kaminak Group volcanic rocks and granodioritic to tonalitic intrusive rocks (figure 11). Interlayered rhyolites and dacites, dacite and andesite, basalt and rhyolite, and massive basalt comprise the Kaminak Group. Both intrusive and extrusive basement rocks are strongly foliated.

Spi Lake group

Rocks of the informally named Spi Lake group occupy a synformal structure west of Carr Lake (figure 11). The Spi Lake basalt is generally massive and fine grained, with some interlayered slates and white-weathering lithic arenites, which define bedding in the unit. Pillowed basalts were found in the southwesternmost outcrop of the area. Along the west limb of the sncline, the basalt is porphyritic with phenocrysts up to 5 cm in length (figure 12).

The contact with the overlying conglomerates is well exposed east of "Old Boot Lake". This locale (figure 11) is suggested as a type section for the Spi Lake group. The intercalated nature of the contact is illustrated in figure 13. Mafic volcanic rocks are intercalated with pebbly arkosic sandstone and ripple-marked, trough cross-stratified aarkosic arenite. Some beds of pebbly arkosic sandstone apparently cut channels in underlying sandstone or valcanics. Mafic bombs are found in the upper 10m of the conglomerate (figures 13 and 14). Outcrops of pebbly arkosic sandstone also occur east of the proposed type section, therefore underlying the Spi Lake basalt.

The last outcrops of basalt occur just north of "Old Boot Lake" and mafic bombs are found in the conglomerate 2 km north of the last basalt outcrops. Clast types in the conglomerate include white weathering granodiorite to tonalite, rhyolite, dacite, andesite, and dark weathering basalt. Clasts range from 15 cm to sand size. The conglomerate varies from very coarse, clast supported on the east side of the syncline (figure 15) to matrix supported, finer grained on the west limb of the syncline (figure 16).

Trough cross-stratification, current ripples, and the channelized nature of the pebbly sandstone beds may be interpreted to indicate a fluvial origin for the arkosic pebbly sandstone at the base of the Spi Lake sequence. The lack of stratification or imbrication and poorly sorted nature of the conglomerate argues for a sediment gravity flow mechanism of deposition for the conglomerates. Intercalation of the pebbly sandstone and basalts, and the presence of mafic bombs in the conglomerates, suggests that deposition of the Spi Lake

group occurred in a tectonically activce rift environment. Mafic volcanism appears to have been restricted to the south half of the syncline. Decrease in clast size and increase in matrix percentage in the conglomerate from east to west suggests a source area and paleo-topographic high east of the present outcrop belt.

Hurwitz Group

The Padlei and Kinga Formations of the Hurwitz Group are exposed in the southwestern termination of the Kaminak-Quartzite belt (figure 11). The rocks are strongly tectonized by a northeast-southwest trending spaced cleavage, and preservation of primary sedimentary structures is rare. On the north limb of the syncline, the fine-grained orthoquartzites of the Kinga Formation are underlain by a very fine-grained, finely cleaved, pink weathering micaceous quartzite (Padlei Formation). Isolated outcrops containing beds of quartz pebble conglomerate (figure 17) in dark, rust stained, fissile siltstone occur west of the river flowing into Carr Lake at the sample location for JP88-192A (figure 11). Matrix supported polymict conglomerate occurs on the south limb of the syncline. The conglomerate was probably deposited by a debris flow. This conglomerate is similar in composition to the Spi Lake conglomertae except that it contains abundant jasper fragments and quartz pebbles.

Discussion

The Spi Lake succession is separated from the Kaminak-Quartzite Belt of Hurwitz Group by outcrops of Archean basement. Padlei Formation conglomerates contain abundant jasper clasts not found in the Spi Lake conglomerate, suggesting a slightly different provenance for the two units, or a different time of deposition. It is tempting to model the Spi Lake sequence as a rift deposit pre-dating the widespread dominantly marine orthoquartzite deposits of the Hurwitz Group, but at this time the linkage between the two groups is unknown.

Padlei Belt

In the Padlei Belt (location 4, figure 1) occurrence of primary structures is patchy due to the structural overprint. At the type section for the Kinga Formation, the Maguse member is present in the lower half of the section. This unit is typically thick to very thickly bedded, and coarse grained. Bi-directional tangential cross-stratification is the most commonly preserved primary structure. Where preserved, the same suite of primary features are present in the Whiterock member as in locations one and two (figure 1). Slates of the overlying Ameto Formation are commonly graded and thinly bedded. Gabbros intruding the Ameto Formation were sampled for geochronology.

Economic Potential

Analyses from Hurwitz Group gabbros, conglomerate, and siltstones, and from the Spi Lake conglomerates are shown in Table 1. Samples were collected from gabbros of the Happotiyik member, Ameto Formation, which showed sulphide mineralization. Siltstone is a host rock for stratiform paleoplacer gold deposits in the Huronian Supergroup (Mossman and Harron, 1984). Samples of Hurwitz siltstone from the basement - Hurwitz contact in the Whiterock and northeast end of the Kaminak-Quartzite belts were analysed.

Rift-related Spi Lake conglomerates have their provenance in a gold bearing granite-greenstone basement, similar to the Witswatersrand type paleoplacer gold deposits (Pretorius, 1976a), and therefore have the potential to be gold bearing. Quartz pebble conglomerates (figure 17) and polymictic conglomerates of the Padlei Formation show minor amounts of gold, but are similar in many respects to stratiform gold-bearing deposits in the Huronian Supergroup (Mossman and Harron, 1984) and Witswatersrand Supergroup (Pretorius, 1976b; Tankard and others, 1982). Further investigation of the Spi Lake conglomerates, and Padlei and Kinga Formations of the Hurwitz Group may lead to the discovery of Witswatersrand or Transvaal type (Pretorius, 1976b) stratiform gold deposits.

Comparison of the Hurwitz Group and Amer Group

Based upon this reconnaissance, it is possible to make some preliminary comparisons of the Hurwitz Group with the Early Proterozoic Amer Group. Both sequences unconformably overlie an Archean basement. Thick, areally extensive orthoquartzite dominates the lower portions of both sequences, but intense deformation in the Amer Group (Patterson, 1986) precludes comparative sedimentology of the two quartzites. In the Amer Belt, carbonate overlies the basal quartzites and is a thick (100-150 m) and widespread unit. Carbonate occurs only sporadically, and at variegated stratigraphic levels, in the observed portions of the Hurwitz Group. In the Amer Group, mafic volcanic rocks are restricted to the core of a narrow syncline along the southeast margin of the Amer Belt (Patterson, 1986), and there is a small mafic intrusion at the southwest end of the Amer Belt (Tella and others, 1984). Conversely, the Hurwitz Group is intruded by gabbro sills both along and across strike (locations 1,2 3, and 4, figure 1) and at location 2, mafic volcanic rocks comprise volumetrically approximately half of the Hurwitz supracrustal rocks. While there are some similarities between the Amer Group and Hurwitz Group, there are obviously significant variations in tectonic evolution of these two groups.

Acknowledgements

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Figure Captions

Figure 1. Map of the southern District of Keewatin showing distribution of the belts of the Hurwitz Group. Locations shown are referred to in the text: 1) southwest end of the Whiterock Belt, 2) northeast end of the Kaminak-Quartzite Belt, 3) southwest end of the Kaminak-Quartzite Belt, and 4) a portion of the Padlei Belt.

Figure 2. Geology of the southwest end of the Whiterock Belt, location 1 on Figure 1. The number and location of rock samples analysed in Table 1 are shown.

Figure 3. a) Rose diagram showing orientations of paleocurrent directions to crossbeds in the Kinga Formation

b) Rose diagram showing orientations of crests of symmetrical (wave) ripples in the Kinga Formation.

Figure 4. Sets of tangential cross-stratification in the Tavani Formation.

Figure 5. Geology of the northeast end of the Kaminak-Quartzite Belt.

Figure 6. Measured section through a well preserved area of Kinga Formation quartzite. Scale is in metres. The top rose diagram shows the orientation of symmetric (wave) ripples in the section. The lower rose diagram illustrates the trend of crest of asymmetric ripples in the measured section; the vectors show direction of asymmetry.

Figure 7. Downplunge section A-A'. Location of section line is shown on Figure 5. No vertical exaggeration.

Figure 8. a) Orientation of symmetric ripple crests at the northeast end of the mapped area.

b) Orientation of symmetric ripple crests at the southwest end of the mapped area.

Figure 9. Interference patterns in ripples, Kinga orthoquartzite at location X (Figure 6).

Figure 10. Pillowed basalts in the Happotiyik member, Ameto Formation.

Figure 11. Geology of the southwest end of the Kaminak-Quarzite Belt. The location of the suggested type section (figure 13) is identified by an open black square adjacent to the location of sample JP88-214A, on the southeast shore of "Old Boot Lake".

Figure 12. Porphyritic lavas in the Spi Lake basalt. Phenocrysts are white weathering.

Figure 13. Proposed type section for the Spi Lake group.

Figure 14. Photograph from the proposed type section of the Spi Lake Group. Assistant Christine Taylor is shown in the background. Geologic hammer is parallel to trend of beding. Dark recessive pits on the surface of the outcrop are weathered mafic bombs in the conglomerate unit. The southeast end of "Old Boot Lake" is shown in the background. White weathering outcrops in the distance are the Spi Lake conglomerate.

Figure 15. Proximal facies in the Spi Lake conglomerate from the east limb of the syncline.

Figure 16. Distal facies in the Spi Lake conglomerate from the west limb of the syncline.

Figure 17. Thin bed of quartz-pebble conglomerate in rust stained fissile slate. Bedding dips 30° southeast, cleavage dips 60° northwest. Sample JP88-192A is from the quartz-pebble bed in this outcrop. Location of the sample is shown on Figure 11.

Figure 1

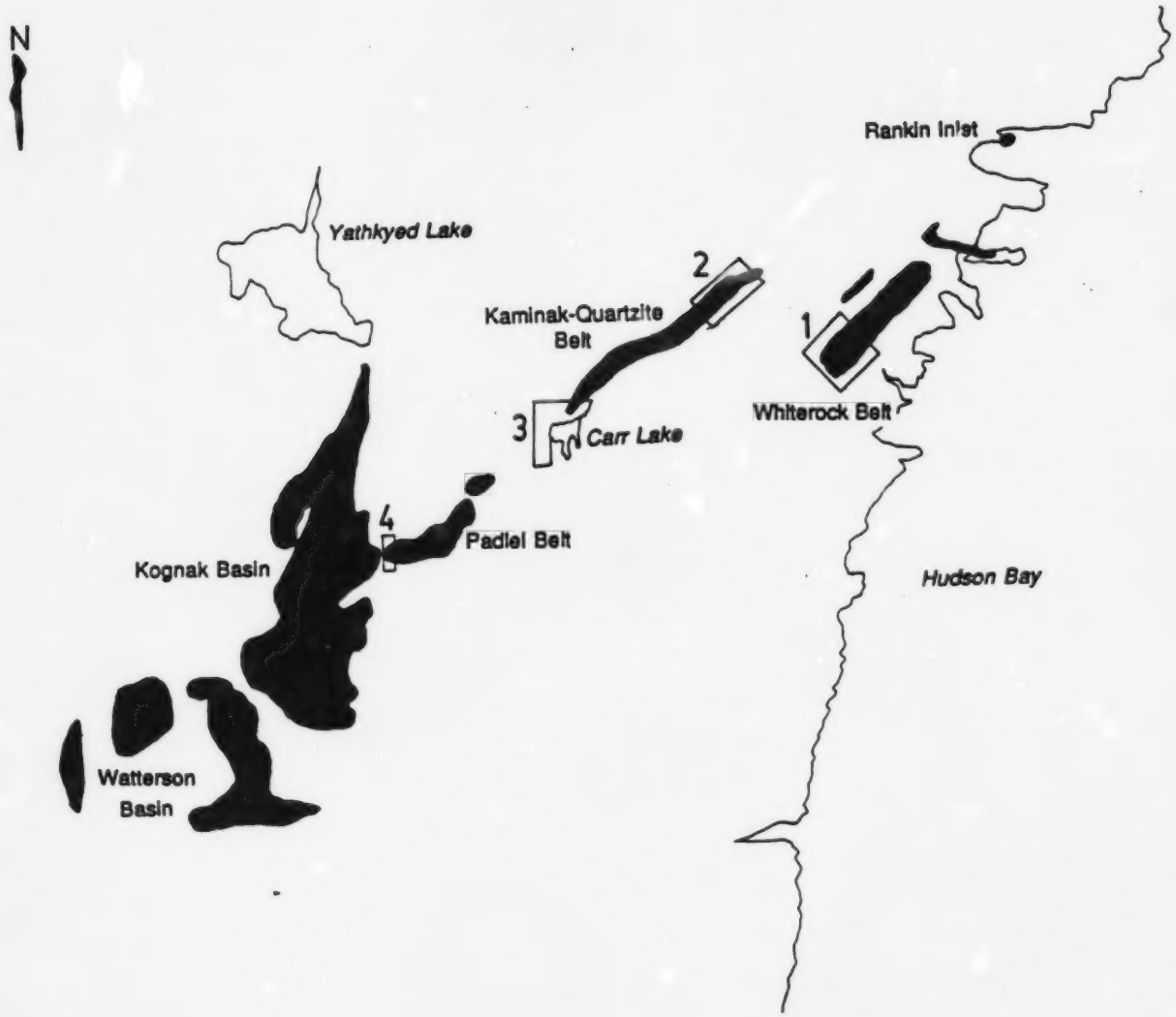

N
Rankin Inlet
Yathkyed Lake
2
Kaminak-Quartzite Belt
1
Whiterock Belt
3
Carr Lake
4
Padlei Belt
Kognak Basin
Hudson Bay
Watterson Basin

Figure 2

Hurwitz Group

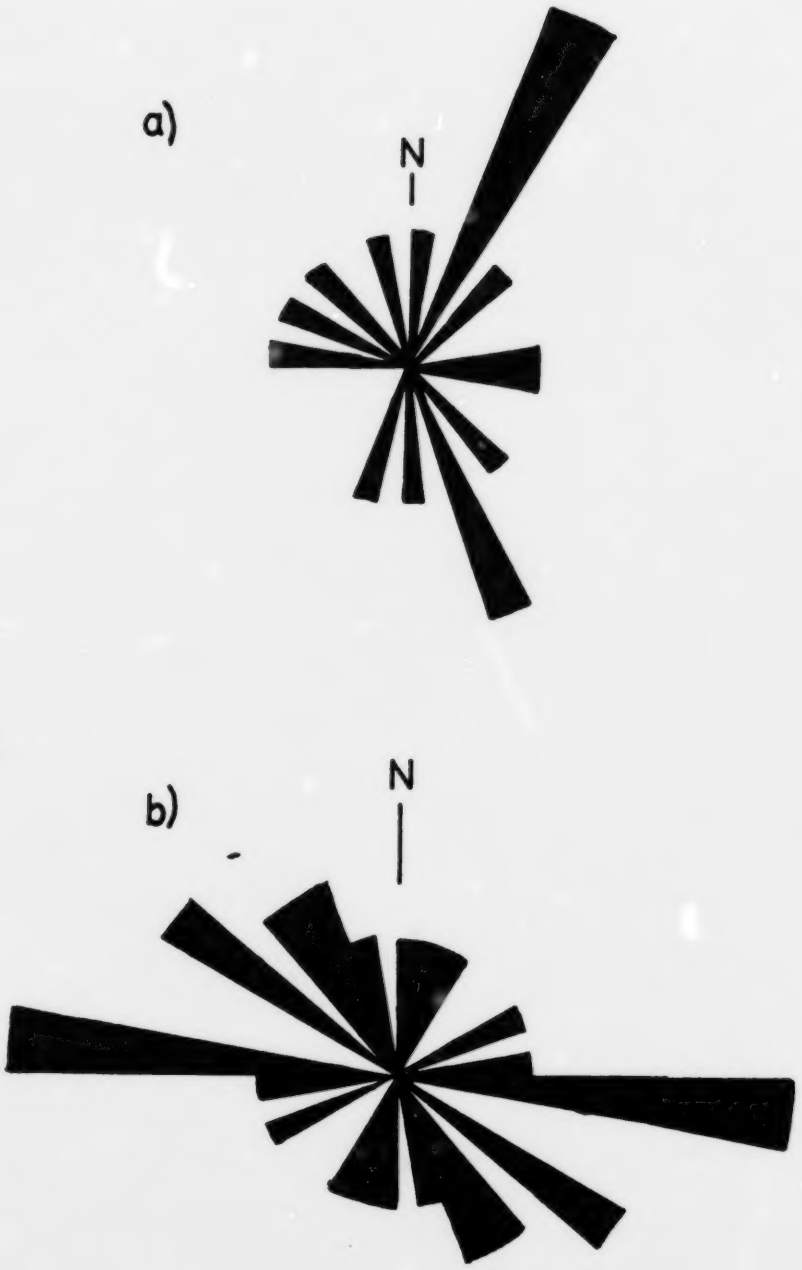
- Tavani Fm.
- Ameto Fm
  - Happotiyik member, basalt
  - Happotiyik member, gabbro
  - carbonate
  - slate
- Kinga Fm, Whiterock member

Kaminak Group

Symbols

- bedding; tops known, overturned, tops unknown
- foliation; inclined, vertical
- upright fold; syncline, anticline
- mesoscopic fold
- fault; sense of movement uncertain
- geological boundary
- ●JP88-1 location and number of analysed sample

Figure 3



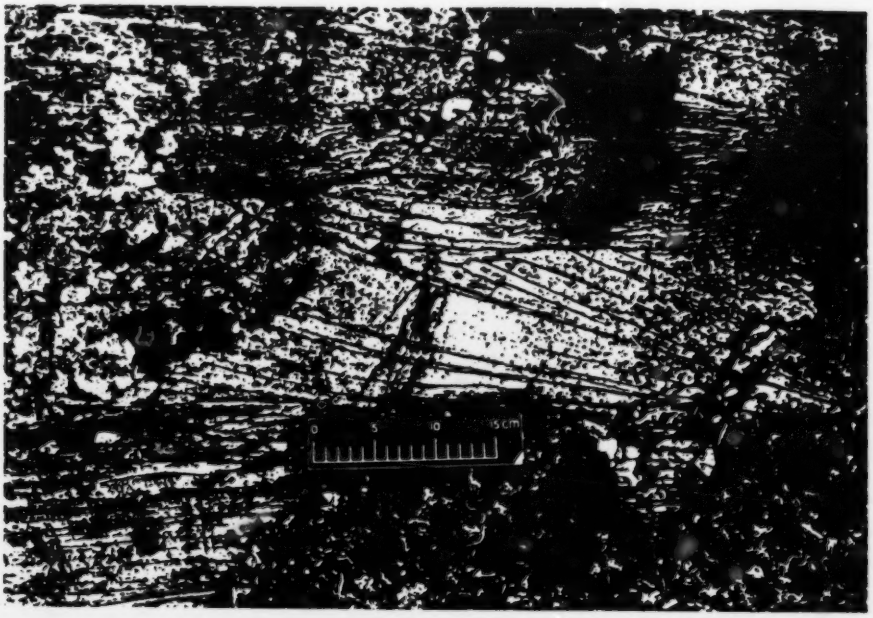


Figure 4

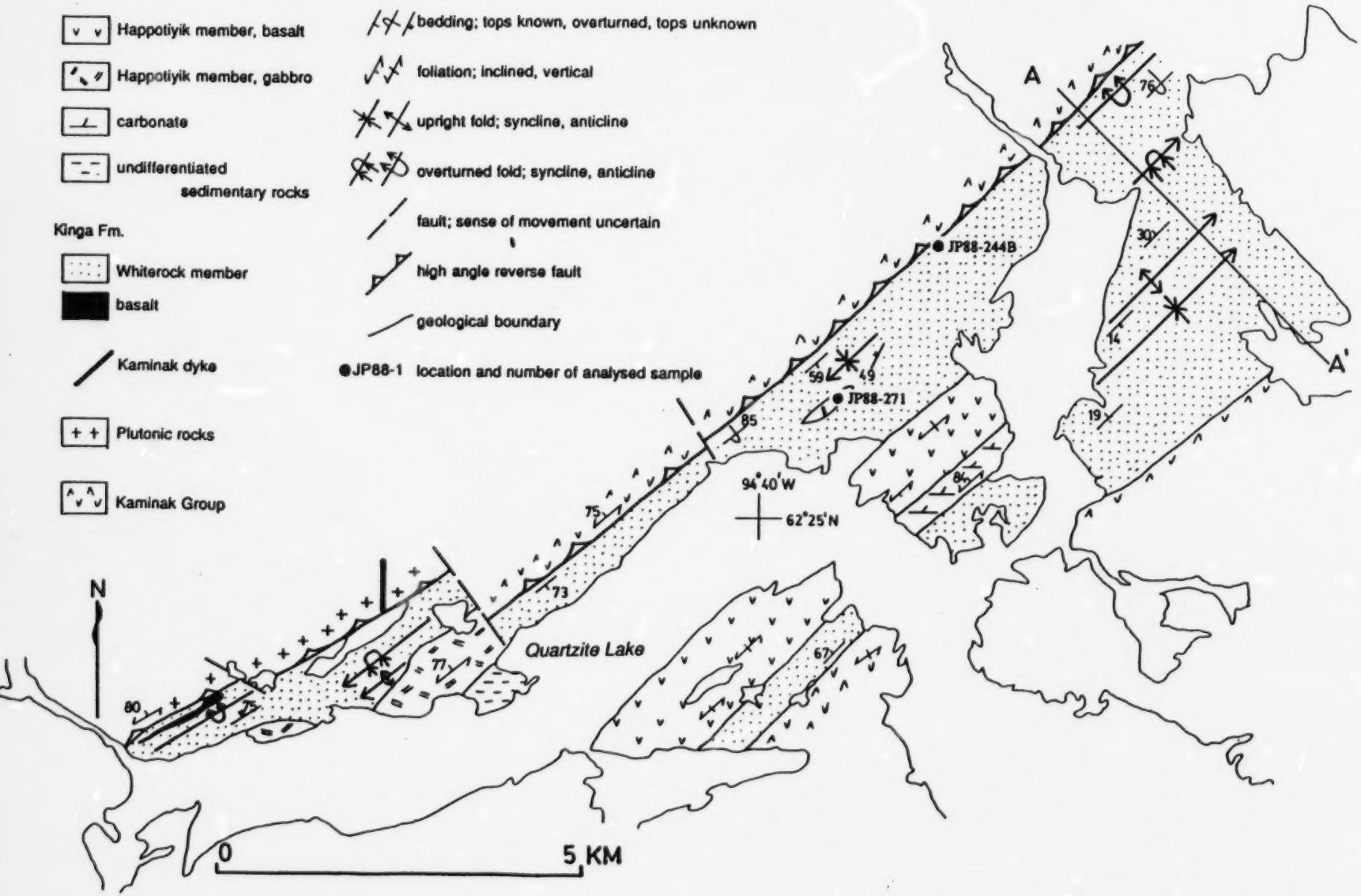

Ameto Fm.
Happotiyik member, basalt
Happotiyik member, gabbro
carbonate
undifferentiated sedimentary rocks
Kinga Fm.
Whiterock member
basalt
Kaminak dyke
Plutonic rocks
Kaminak Group
Symbols
bedding; tops known, overturned, tops unknown
foliation; inclined, vertical
upright fold; syncline, anticline
overturned fold; syncline, anticline
fault; sense of movement uncertain
high angle reverse fault
geological boundary
●JP88-1 location and number of analysed sample
JP88-244B
JP88-271
94°40'W
62°25'N
Quartzite Lake
A
A'
N
0
5 KM

Figure 5

Figure 6

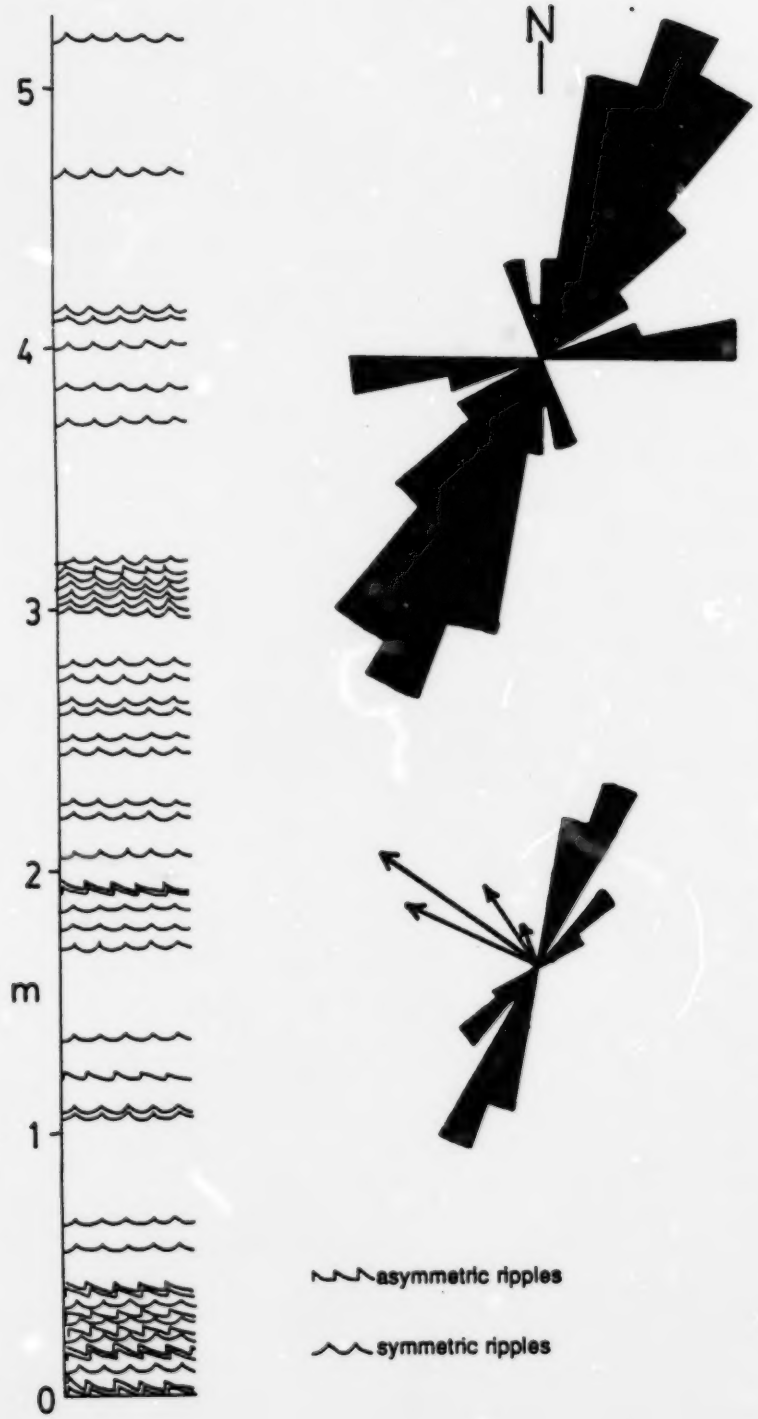


Figure 7

Figure 8

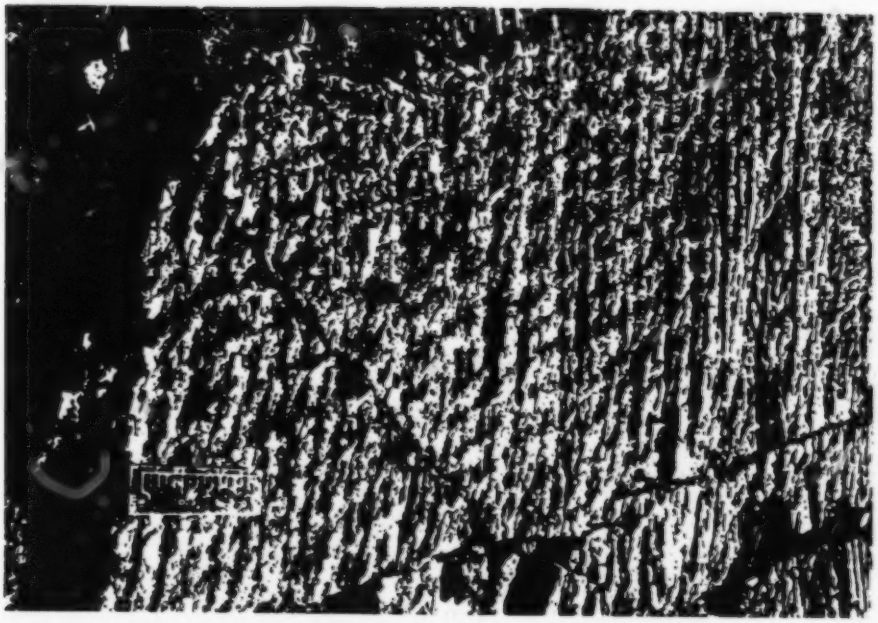
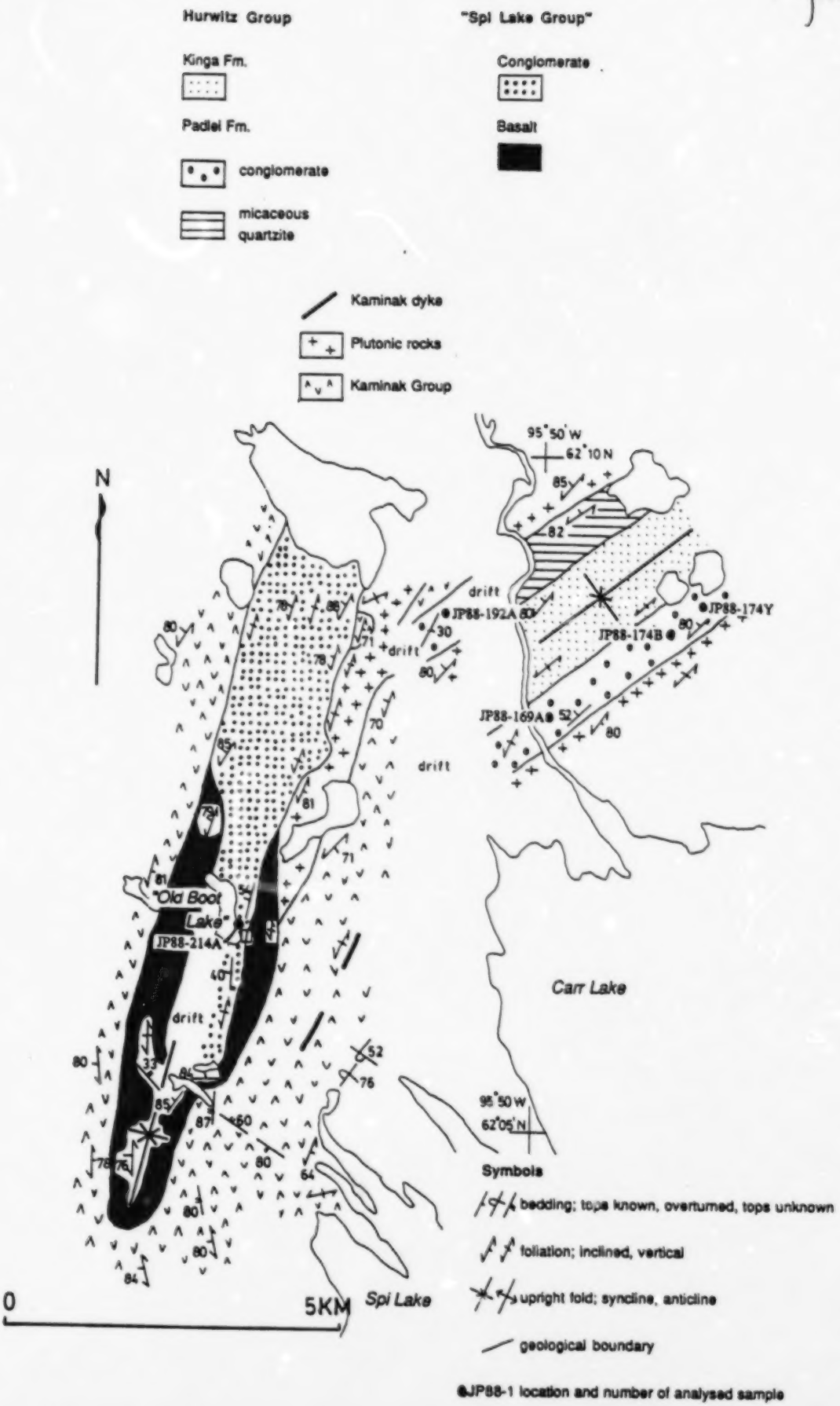


Figure 9

Figure 10

figure 11


Hurwitz Group
Kinga Fm.
Padlei Fm.
conglomerate
micaceous quartzite
"Spi Lake Group"
Conglomerate
Basalt
Kaminak dyke
Plutonic rocks
Kaminak Group
N
95°50'W
62°10'N
95°50'W
62°05'N
drift
JP88-192A
JP88-174Y
JP88-174B
JP88-169A
"Old Boot Lake"
JP88-214A
Carr Lake
Spi Lake
0
5KM
Symbols
bedding; tops known, overturned, tops unknown
foliation; inclined, vertical
upright fold; syncline, anticline
geological boundary
JP88-1 location and number of analysed sample

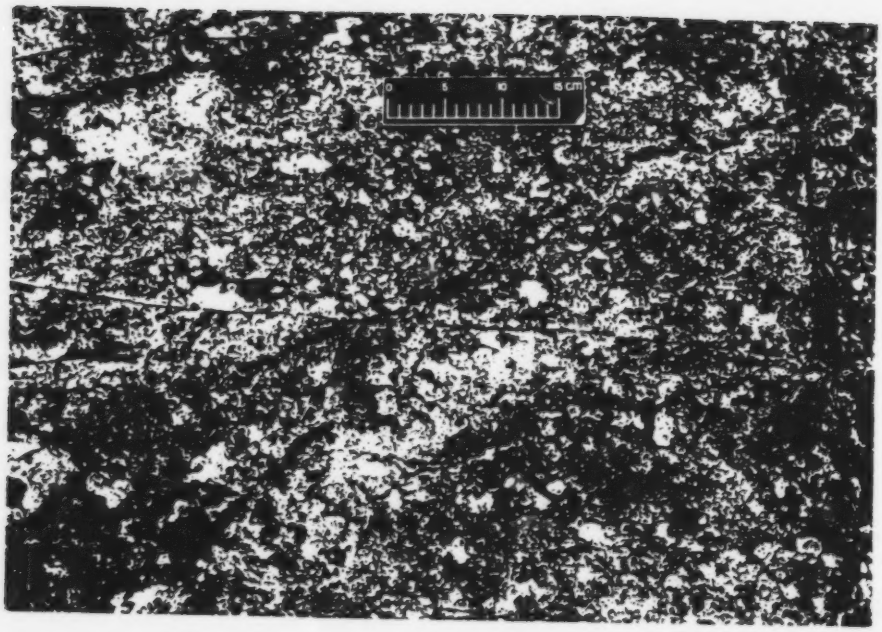


Figure 12

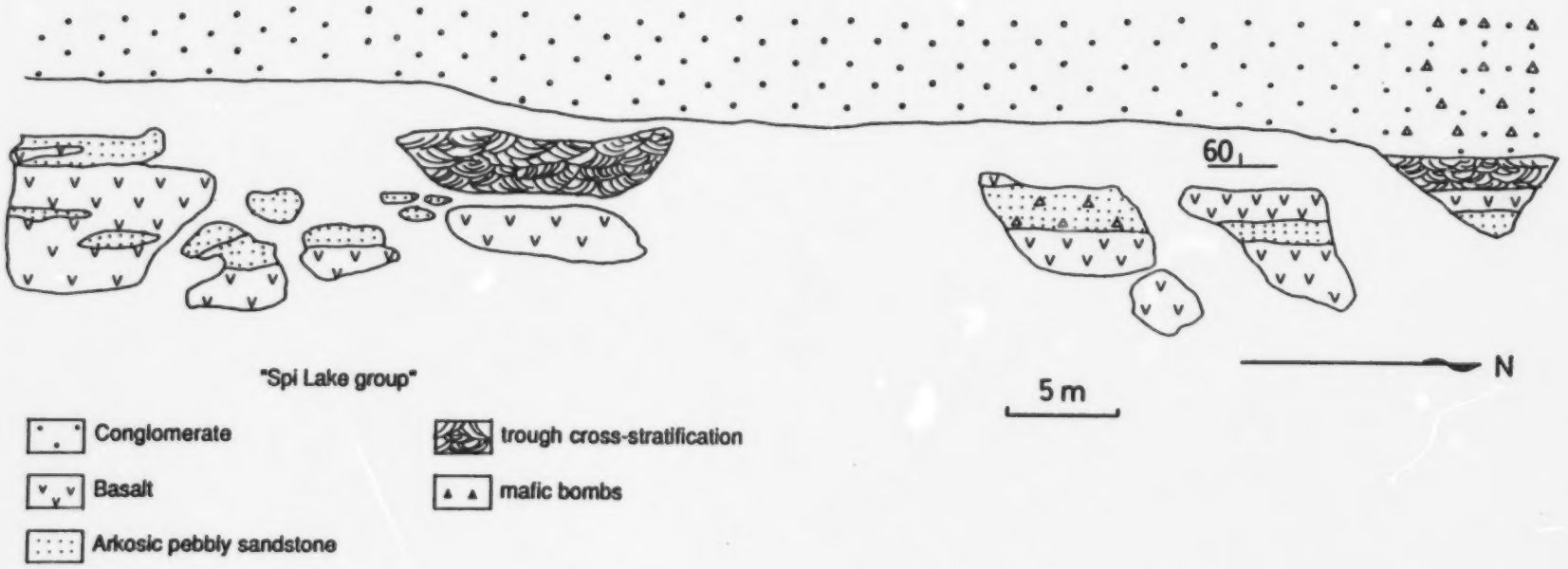

60
N
5 m
"Spi Lake group"
Conglomerate
Basalt
Arkosic pebbly sandstone
trough cross-stratification
mafic bombs

Figure 1

Figure 14

Figure 15

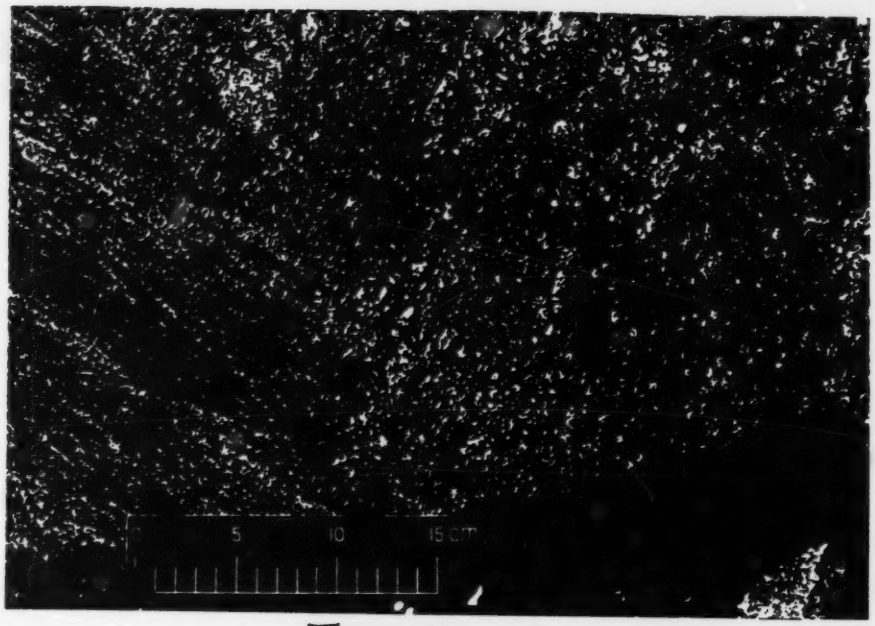


Figure 16

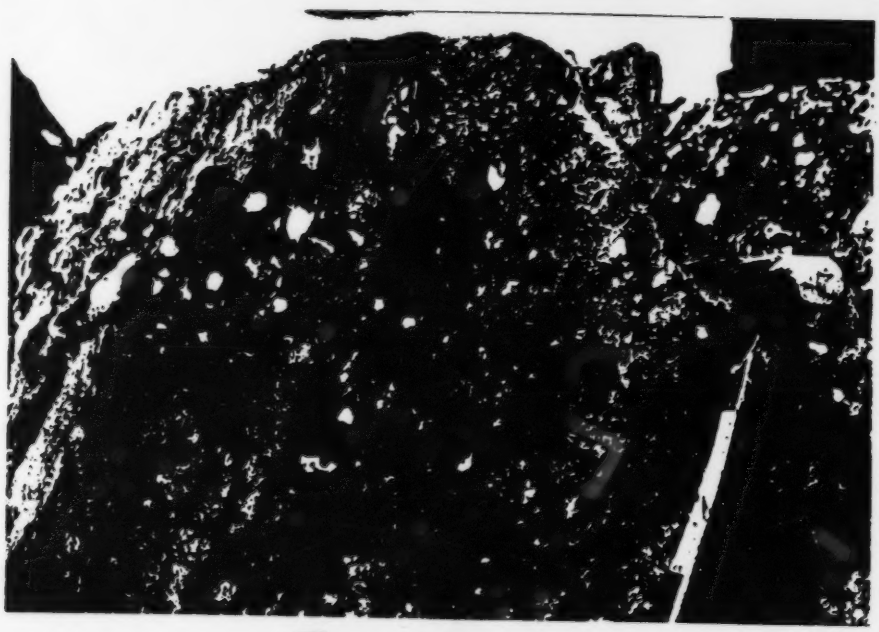


Figure 17

TABLE 1

Sample number		Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppb	Mo ppm	Na ppm	Ni ppm	Rb ppm	Sb ppm	Sc ppm
Detection limits		5	5	2	100	1	1	5	10	2	0.02	1	1	5	5	500	50	30	0.2	0.1
Whiterock Lake																				
JP88-1	gabbro	-	-	-	150	-	-	34	180	-	7.69	2	-	-	-	15100	50	-	0.4	32
JP88-14B	basal slate	-	-	-	-	-	-	36	110	4	7.47	2	-	-	-	6180	-	51	1.1	44
JP88-21	basal slate	-	-	-	-	-	-	26	190	4	6.57	1	-	-	-	-	100	66	0.5	43
JP88-56	gabbro	-	-	-	-	-	6	37	130	-	8.41	4	-	-	9	15000	-	-	1.1	36
JP88-85	gabbro	5	-	16	-	-	5	35	190	-	8.03	3	-	-	-	17700	84	-	2.3	36
JP88-86	gabbro	-	-	4	-	-	7	38	180	-	8.18	2	-	-	-	12200	-	-	-	33
JP88-88	gabbro	-	-	12	260	-	6	36	180	-	8.31	3	-	-	-	16200	-	-	2.2	35
Spi Lake and Southwest end of the Kaminak - Quartzite Belt																				
JP88-169A	Hurwitz conglomerate	5	-	4	210	-	-	-	140	-	1.33	6	-	-	7	937	-	45	0.6	5.5
JP88-174B		8	-	2	100	-	-	-	200	-	0.86	1	-	-	-	11000	-	-	0.3	1.5
JP88-174Y		15	-	-	300	-	-	5	140	-	1.75	3	-	-	-	14000	-	38	0.5	5.7
JP88-192A		8	-	-	310	-	-	-	150	-	3.40	3	-	-	-	2300	-	50	0.4	11
JP88-214A	Spi Lake conglomerate	-	-	-	210	1	-	6	140	-	1.53	6	-	-	-	15300	-	51	0.6	4.0
Northeast end of the Kaminak - Quartzite Belt																				
JP88-244B	basal slate	-	-	-	200	-	-	-	160	-	1.15	3	-	-	-	-	-	-	1.3	2.7
JP88-271	gabbro	-	-	-	-	-	4	32	270	-	5.61	-	-	-	-	19000	-	-	-	33

(-) below detection limits

TABLE 1 (Continued)

Sample number		Se ppm	Sr %	Ta ppm	Th ppm	V ppm	W ppm	Zn ppm	La ppm	Ce ppm	Nd ppm	Sm ppm	Ev ppm	Tb ppm	Yb ppm	Lu ppm
Detection limits		5	0.05	1	0.5	0.5	4	50	1	3	5	0.1	0.2	0.5	0.05	0.05
Whiterock Lake																
JP88-1	gabbro	-	-	-	1.2	-	-	100	11	17	-	2.3	0.9	-	1.67	0.21
JP88-14B	basal slate	-	-	-	-	-	-	88	4	7	8	1.7	0.5	-	2.40	0.29
JP88-21	basal slate	-	-	-	-	1.7	-	62	2	-	-	0.7	0.2	-	1.09	0.15
JP88-56	gabbro	-	-	-	1.3	2.3	-	110	15	21	17	3.5	1.1	-	2.58	0.49
JP88-85	gabbro	-	-	-	1.3	-	-	140	12	18	10	2.8	1.0	-	1.86	0.22
JP88-86	gabbro	-	-	-	1.0	-	-	90	12	17	15	2.6	0.9	-	2.28	0.37
JP88-88	gabbro	-	-	-	1.6	-	-	79	11	17	14	2.6	1.0	0.9	1.99	0.20
Spi Lake and Southwest end of the Kaminak - Quartzite Belt																
JP88-169A	Hurwitz	-	-	-	5.6	2.1	-	-	24	39	18	3.3	0.9	-	1.29	0.25
JP88-174B	Conglomerate	-	-	-	1.5	-	-	-	7	8	5	0.8	-	-	0.34	-
JP88-174Y		-	-	-	4.1	1.3	-	-	20	28	13	2.0	0.5	-	1.05	0.19
JP88-192A		-	-	-	2.2	1.0	-	-	17	27	13	2.2	0.7	-	1.05	0.20
JP88-214A	Spi Lake conglomerate	-	-	-	3.5	1.2	-	-	23	29	12	2.4	0.8	0.5	0.94	0.14
Northeast end of the Kaminak - Quartzite Belt																
JP88-244B	basal slate	-	-	-	1.8	-	-	-	8	10	7	0.9	0.4	-	0.57	-
JP88-271	gabbro	-	-	-	-	1.8	-	-	5	8	-	1.0	0.4	-	1.17	0.18

(-) below detection limits